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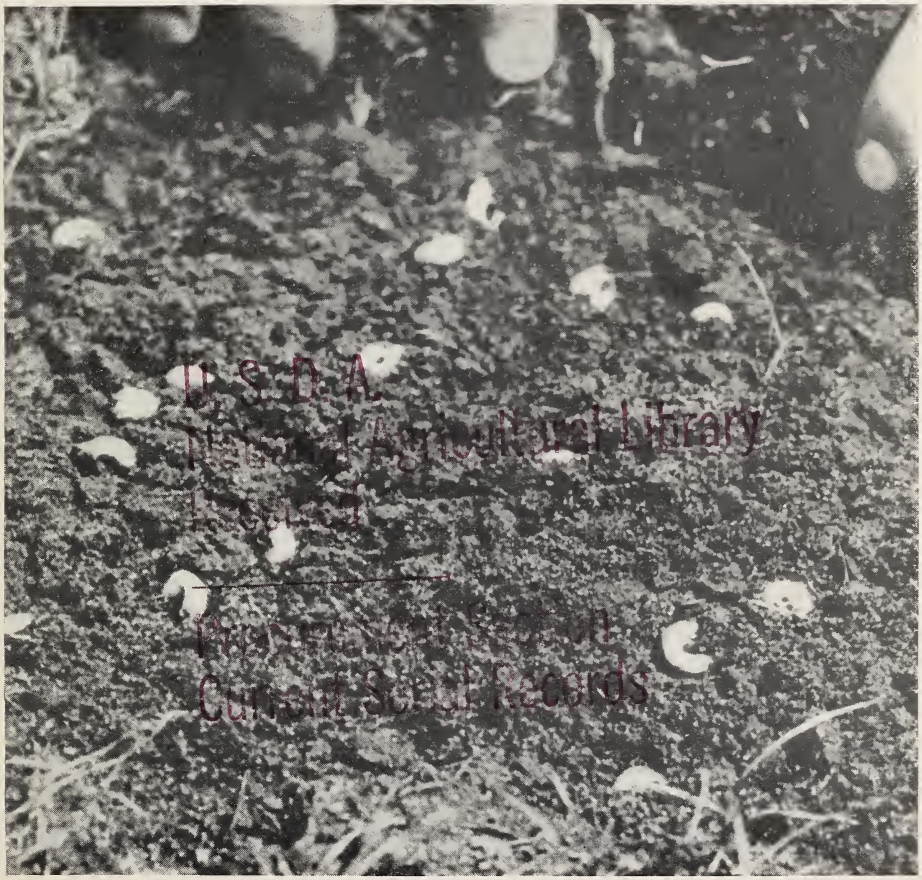

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PROTECTION OF TURF FROM DAMAGE BY JAPANESE BEETLE GRUBS[1]

By W. E. Fleming, *entomologist, Division of Fruit Insect Investigations, Bureau of Entomology and Plant Quarantine, Agricultural Research Administration*

MANY PARKS, golf courses, and other lawn areas in the eastern part of the United States have been ruined by grubs of the Japanese beetle.[2] The grubs feed on the roots of the grass until the part above ground dies. Patches of brown grass appear, becoming larger as the grubs feed and grow; sometimes the injured area will cover several acres. Grubs of the oriental beetle[3] and the Asiatic garden beetle[4] cause similar injury, but their occurrence is much less common.

This leaflet tells how to determine whether Japanese beetle grubs are present and how to keep them from injuring turf.

APPEARANCE AND HABITS OF THE GRUBS

The Japanese beetle grub is a blunt-ended, creamy-white larva with three pairs of legs, a hard yellowish or brownish head, and a slight covering of hair. It is usually found in the soil curled in the position indicated in figure 1. Grubs of the oriental beetle and the Asiatic garden beetle look much like those of the Japanese beetle. All of them are similar in appearance to our native white grubs but are smaller. Fully developed grubs of the Japanese and oriental beetles are about 1 inch long and those of the Asiatic garden beetle about ⅔ inch long.

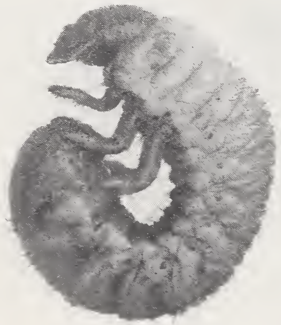

Figure 1.—Full-grown Japanese beetle grub, enlarged.

In the infested areas Japanese beetle grubs are present in the soil during most of the year. The eggs are laid in the soil in midsummer, and the grubs hatch in about 2 weeks. They feed on the grass roots near the surface until cold weather, and then burrow deeper into the ground, where they spend the winter. In the spring they return nearly to the surface, feed for a few weeks and, after a brief resting period, emerge from the ground as adult beetles. The accompanying chart (fig. 2) shows where the grubs are located in the soil from month to month.

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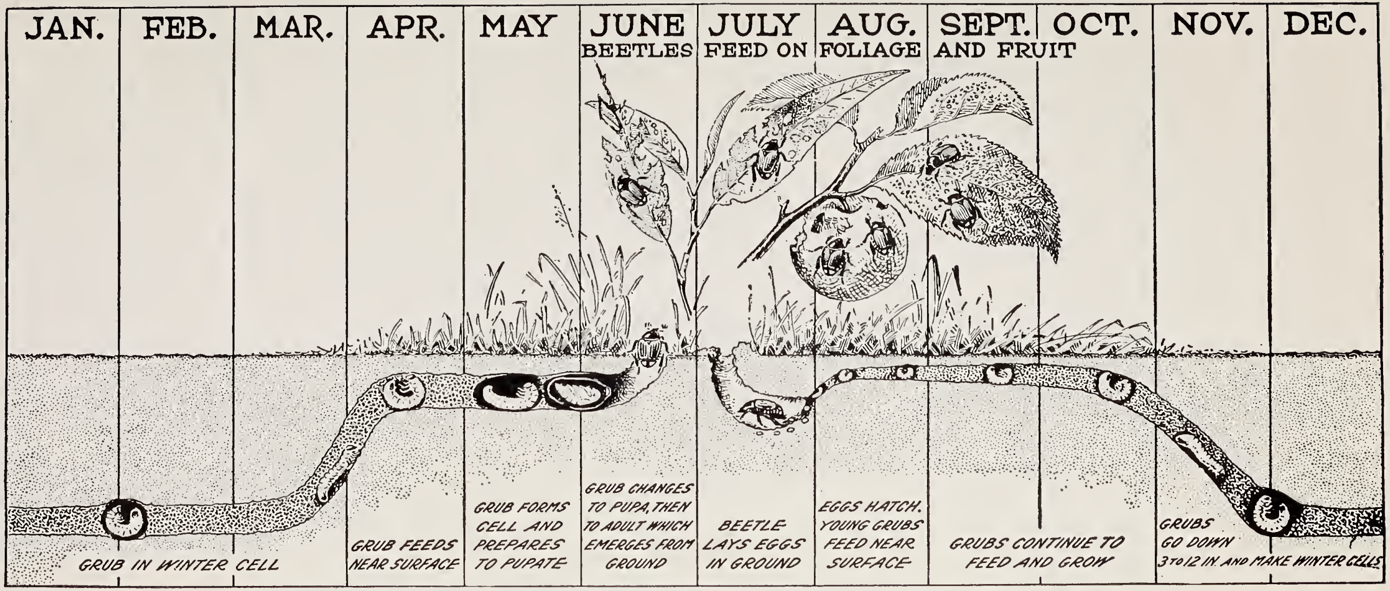
[1] This leaflet supersedes Circular 403, Preventing Injury From Japanese and Asiatic Beetle Larvae to Turf in Parks and Other Large Areas. For additional information see Farmers' Bulletin 2004, Controlling the Japanese Beetle.

[2] *Popillia japonica* Newm.

[3] *Autoserica castanea* Arrow.

[4] *Anomala orientalis* Waterh.


JAN.
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BEETLES FEED ON FOLIAGE AND FRUIT
GRUB IN WINTER CELL
GRUB FEEDS NEAR SURFACE
GRUB FORMS CELL AND PREPARES TO PUPATE
GRUB CHANGES TO PUPA, THEN TO ADULT WHICH EMERGES FROM GROUND
BEETLE LAYS EGGS IN GROUND
EGGS HATCH. YOUNG GRUBS FEED NEAR SURFACE
GRUBS CONTINUE TO FEED AND GROW
GRUBS GO DOWN 3 TO 12 IN. AND MAKE WINTER CELLS

Figure 2.—Seasonal life cycle of the Japanese beetle. The life cycles of the oriental beetle and the Asiatic garden beetle are very similar.

The grubs are more abundant in open grasslands and in sunny parts of the lawn than in areas shaded for the greater part of the day. During summers with normal rainfall they are generally distributed over the lawn, but in dry seasons more of them are in moist portions of the area.

INJURY TO THE GRASS

As the grubs feed on the grass roots, they cut off the portion of the grass above ground so that it cannot receive food and water and therefore dies. The turf under this dead brown grass becomes soft and spongy and can be rolled back with the fingers.

Since brown patches of grass may be due to other causes, such as drought, disease, and other insects, the turf should be examined carefully to see whether these grubs are responsible. In sections of the country where these beetles are known to occur, examinations should be made each fall. The following procedure has been found satisfactory:

With a spade a square foot of sod is cut on three sides to a depth of 2 to 3 inches. The spade is then forced beneath the sod and the sod laid back with the uncut side as a hinge. The exposed soil is then examined for grubs to a depth of 2 inches. The soil about the roots of the overturned grass is removed with a sharp trowel to dislodge any grubs there. After the grubs have been counted, the sod is replaced. The procedure is repeated at other spots until a sufficient area has been examined to determine the severity of the infestation. A dozen spots should be enough.

If the examination shows only one or two grubs per square foot, the turf need not be treated at once. Their presence should serve as a warning, however. When six or more grubs per square foot are found, treatment should be made promptly to save the grass from possible injury.

TREATMENT OF ESTABLISHED TURF

Established turf can be made practically immune to injury with applications of lead arsenate, DDT, or chlordane. These poisons sink into the soil, and as the grubs burrow and feed they take it into their bodies.

A dust containing spores of milky disease may also be used to control these grubs. This treatment is of considerable value after the disease becomes established, which often requires several years. Only treatments with insecticides are discussed here.

Use of Lead Arsenate

Lead arsenate has long been used for grub-proofing turf. One application as a top dressing generally protects established turf from grub injury for at least 5 years.

It is a slow poison. From 2 to 4 weeks are required to kill newly hatched grubs and from 8 to 10 weeks to kill full-grown ones. However, they do little feeding after the poison begins to affect them, and they soon become flabby and discolored. Grubs are killed more slowly in soils rich in iron or organic matter than in other types.

For use as a spray lead arsenate should be added to water, 1 pound to 2 gallons, and applied at the rate of about 900 gallons per acre, or 20 gallons per 1,000 square feet. When used as a dust, lead arsenate should be applied at the rate of 435 pounds per acre, or 10 pounds per 1,000 square feet of turf.

Use of DDT

DDT has been used for grub control in the last few years. It kills grubs more than twice as fast as does lead arsenate. When a grub swallows particles of DDT with the soil, it soon becomes paralyzed, stops feeding, and dies. DDT has given good results in all types of soil although its action is a little slower in soil high in organic matter. This insecticide is effective in the soil about as long as lead arsenate.

DDT should be used at the rate of 25 pounds of the technical material per acre. For use as a spray a 50-percent DDT wettable powder may be mixed with water, 1 pound to 20 gallons, and applied at the rate of 1,000 gallons per acre. A dust containing 10 percent of DDT should be applied at the rate of 250 pounds per acre or 6 pounds to 1,000 square feet.

Use of Chlordane

Chlordane is a newer insecticide, which was first used for grub control in 1947. It kills grubs faster than either DDT or lead arsenate. An infestation can be practically wiped out in 2 or 3 weeks by treating the soil with chlordane early in the fall or in the spring just before the grubs become active. How long the chlordane treatment will keep turf free from grub injury has not yet been determined, although it is known to be effective for at least 3 years.

Chlordane should be used at the rate of 10 pounds of the technical material per acre. For use as a spray a 50-percent chlordane wettable powder may be mixed with water, 1 pound to 50 gallons, and applied at the rate of 1,000 gallons per acre. A 5-percent chlordane dust may be used at 200 pounds per acre or 5 pounds per 1,000 square feet.

How To Apply the Poison

For treating large turf areas with sprays, power equipment capable of developing a pressure of 200 to 300 pounds per square inch may be used. There should be some means of agitating the mixture to keep the insecticide in suspension during the spraying.

When the turf is solid enough for the sprayer to be driven over it, the spray boom may be attached to the rear of the sprayer. The nozzles should deliver a coarse fan-shaped spray and should be arranged so that the spray will cover the ground uniformly. When the power sprayer is too heavy to take onto the turf, it can be placed in such a location that one or more lines of hose can be laid to the area to be treated. The man at the nozzle, assisted by as many others as are needed to keep the hose and connections from dragging on the turf, begins to apply the spray at the point farthest from the machine (fig. 3). With a little experience he can adjust his gait so that he will apply the desired quantity.

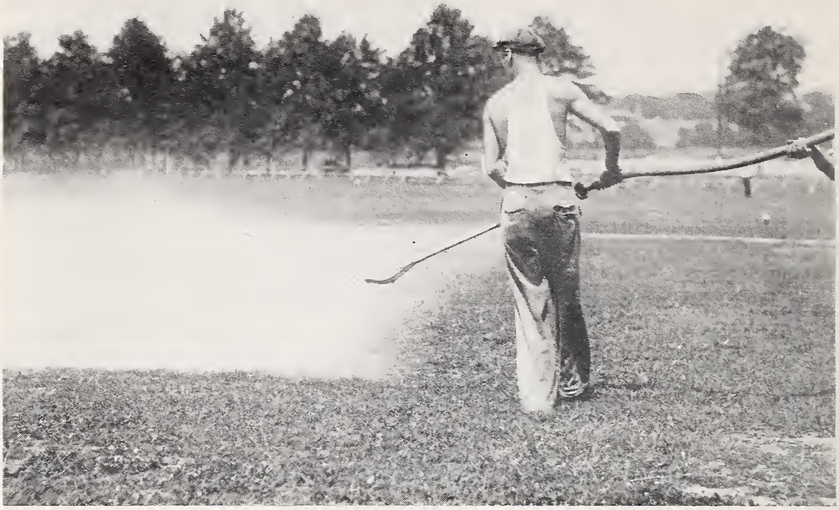

Figure 3.—Applying a poison spray with a hose.

For treating large areas with the insecticide in dust form, a large fertilizer distributor may be used (fig. 4).

For treating small lawns the dust is more satisfactory. A garden fertilizer spreader or seeder can be used for this purpose (fig. 5) but if such equipment is not available the dust can be mixed with sand, soil, or organic fertilizer and broadcast by hand. Lead arsenate should not be mixed with inorganic fertilizers, such as superphosphate, ammonium sulfate, sodium nitrate, or potassium chloride, as such mixtures sometimes injure the grass slightly; neither should

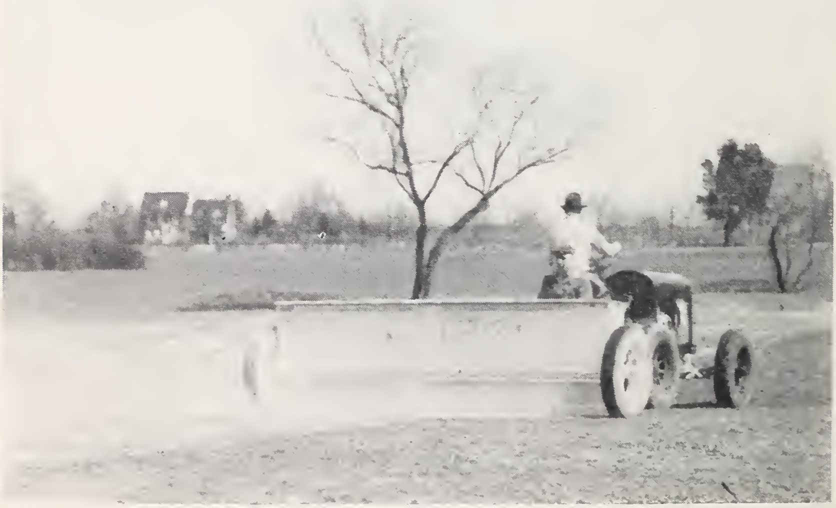

Figure 4.—Applying an insecticide dust on large areas.

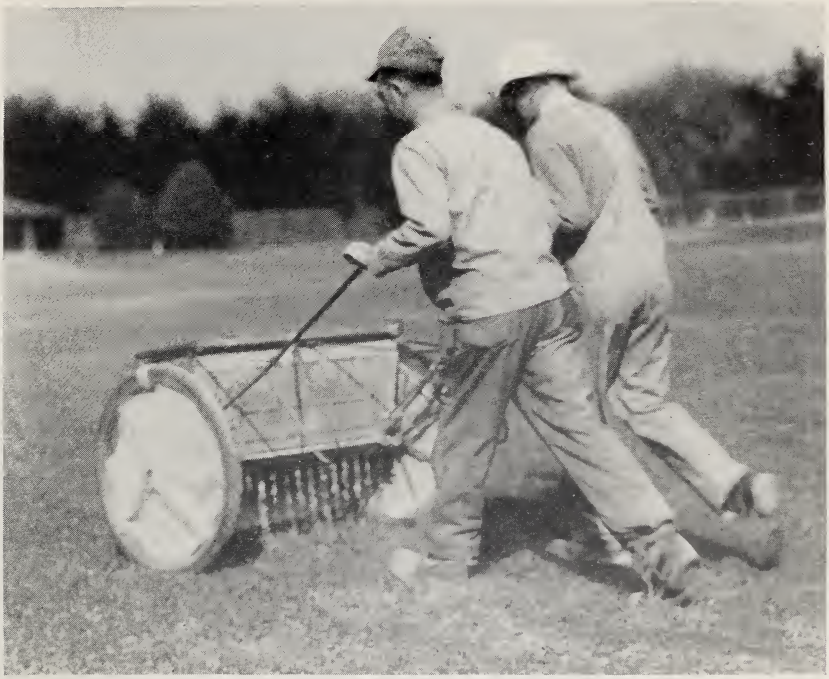

Figure 5.—Applying an insecticide dust with a small fertilizer spreader.

it be mixed with tankage, because this material is very attractive to dogs and cats and the lead arsenate would poison them.

After a treatment the turf, particularly around dwellings, should be watered well to wash the poison into the soil.

When To Treat the Turf

These poisons can be applied at any season of the year when the ground is not frozen. However, the grubs will be killed more quickly if the poison is in the soil during the summer while the eggs are hatching. In the fall the soil is cooler and the grubs are larger and more resistant. The poisons work more slowly at lower temperatures and have no effect on the inactive grubs during the winter.

Treatments made in the spring may be only partially effective against the grubs present at that season, because they soon stop feeding and change into adult beetles. However, either a spring or a fall treatment will be very effective against the new generation of grubs that hatch during the summer.

CAUTIONS IN HANDLING THESE INSECTICIDES

Lead arsenate, DDT, and chlordane are poisonous to man and animals. Children and domestic animals should be kept off treated turf until the insecticide has been washed into the soil.

The operator should be careful not to inhale the dust or get it into his mouth. If operating conditions are such that there is danger of inhaling a dust or spray, a suitable respirator should be worn.

Because these poisons can be absorbed into the system through cuts and scratches on the skin, the operator should wear gloves while doing this work.

Work clothes should be laundered frequently if they become contaminated with poison. The poisons should be stored in plainly labeled containers, away from food, and out of the reach of children and pets.

Care of Turf After Treatment

After lead arsenate, DDT, or chlordane has been applied to the turf, the operations of mowing, watering, and fertilizing can be carried on as usual. Lime should not be used on poisoned soil except when necessary to correct soil acidity. When it is necessary to use soil as a top dressing on treated turf, one of these insecticides should be mixed with it to provide a poisoned layer of soil at the surface of the ground.

TREATMENT OF NEW TURF

Before a new area is seeded to grass, a few samples of soil should be examined carefully for grubs. If as many as 10 to 12 grubs per square foot are present, lead arsenate, DDT, or chlordane dust should be applied at the same rate as for treating established turf, and mixed with the upper 2 or 3 inches of soil. If applied before the grass seed is sown, this treatment will keep the grubs from destroying the grass as soon as it begins to come up. If only one or two grubs per square foot are found in the soil, treatment may be delayed until the turf has become established. Grass seed germinates more slowly in poisoned soil.

PASTURES

As a rule is is neither desirable nor practicable to treat pastures with lead arsenate, DDT, or chlordane. There is danger of poisoning livestock until the insecticide has been washed in by rains or until new grass has grown. Moreover, the cost is not usually justified.

GRASSES NOT INJURED BY INSECTICIDES

Some plants are injured by lead arsenate, DDT, or chlordane. However, white clover and the following grasses have been grown successfully in soils treated with these insecticides:

Astoria bent
Bermuda grass
Canada bluegrass
Chewings fescue
Colonial bent
Creeping bent
Italian ryegrass
Kentucky bluegrass
Meadow fescue
Metropolitan bent
Orchard grass
Perennial ryegrass
Red fescue
Redtop
Rough-stalked bluegrass
Velvet bent
Washington bent

AVOID INJURING BIRDS

When a residue of DDT or chlordane is left on the ground without being washed in, a few birds that feed on grubs, other insects, and earthworms near the surface of the ground may be killed. Injury to birds may be avoided by prompt watering after applying the insecticide, by putting it on just before a heavy rain is expected, or at a time in the year when the kinds of birds likely to be poisoned are absent. Experimental treatments have not caused any losses of poultry.

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